Magnetic Measurement Lab
Hall Probe System Calibration Operation
METHOD OF PROCEDURE

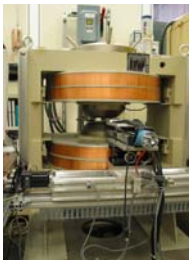
August 8, 2003

Advanced Photon Source, Argonne National Lab
9700 S. Cass Ave, Argonne, IL 60539

Introduction

This document provides a Method of Procedure (MOP) for the Operation of the Hall Probe equipment Calibration System. The Hall probe equipment calibration system is designed to calibrate the Hall Probe Systems. Those Hall Probe Systems are used to characterize the APS Insertion Device (ID) magnetic field spatial distribution profiles. The calibration system consists of a Mangetic Power Supply, an Electrical Magnet, a Reference Teslameter, an NMR Teslameter, a Motorized Probe Stage, and a Multimeter.

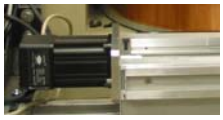
MPS-853 Magnetic Power Supply



Electrical Magnet

DTM-141 Ref. Teslameter

PT-2025 NMR Teslameter



SmartMotor Motorized Stage

HP-3458A Multimeter

This document is intended to provide operators a quick guide of the Calibration System operation. Please refer to the User's Guide of the system and the User's Manual of the sub-systems for detailed information.

Method of Procedure

To start a calibration, the hardware sub-system connections have to be checked and powered on. If any of the sub-system is not connected and powered on appropriately, the software system will inform you that a specific hardware system is not connected or power up or set to a specific address setting.

The Magnetic Power Supply MPS 853 system and the Electrical Magnet have to be water cooled. The water supply has to be turned on. Otherwise, the MPS 853 Power Supply will not function and its software module will generate interlock messages inform the users that the water interlock system is tripped off. Therefore, all the interlock alarms have to be cleared before the system can be operated appropriately.

Step 1. Check all the cables, GPIB cables, Serial cables, Power cables, NMR Probe and their amplify signal cables, as well as the Hall probe cables (for bother DTM-141 and HP 3458A) are properly connected and secured.

Step 2. MPS 853 Electrical Magnet Power Supply Water Cooling Valve is ON.

Step 3. MPS 853 MPS 853 Electrical Magnet Power Supply Main Power Switch is OFF.

Step 4. Turn on all the power switches of the sub-systems including:

- The power supply of the SmartMotor that controls the NMR Probe Stage.
- The DTM-141 Digital Teslameter Power.
- The PT-2025 NMR Teslameter Power.
- The HP-3458A Multimeter Power
- The MPS-853 Electrical Magnet Power Supply Control Power.
- The MPS-853 Electrical Magnet Power Supply Output Power.

Step 5. Launch the Calibration Control Software by double click the CALIBsys icon on the Windows Desktop.

Step 6. If any of windows pop out asking you to check cable connections, power, and address settings, click OK buttons, check the appropriate cable connections, power cables, and address settings, and restart the program.

System Preparation Procedure

Before calibration starts, collect all the information about the probe needs to be calibrated. The preparation includes the following steps:

Step 7. Collect the Hall probe information including:

- The manufacture.
- The part number.
- The serial number.
- The **k** constant (Tesla per Volts).
- Other information as necessary.

Step 8. Measure the Hall probe zero field offset:

- Put a zero field μ-metal can on the probe.
- Click the **HP 3458A** control button on the main control panel.
- Click the **MEASURE** control button on the HP 3458A control panel.
- Write down the measurement value in volts.
- Click the **RETURN TO MAIN** control button on the HP 3458A control panel to quit the sub-control panel.

System Alignment Procedure

After the preparation, the system needs to be properly aligned, before calibration scan can be executed.

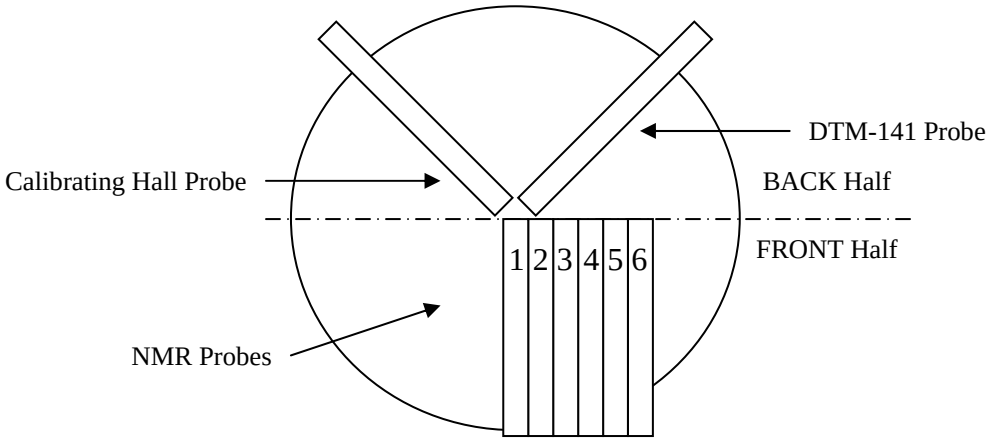
Step 9. Click the **MPS 853** control button on the main control panel to launch the MPS-853 power supply control panel. Enter 5,000 to the **Targeted ADC Setting** field and click the **SET ADC** control button. Click the **POWER** control button to turn on the power switch. You hall hear the power supply power switch relay clicks.

Step 10. Click the **RETURN TO MAIN** control button on the **MPS 853** control panel to quit the sub-control panel.

Step 11. Click the **RETURN TO MAIN** control button on the **MPS 853** control panel to quit the sub-control panel.

Step 12. Click the **HP 3458A** control button on the main control panel.

Step 13. Align the Hall probe needs to be calibrated to the BACK Left quarter of the Electric Magnet. ***Make sure the probe is clear with the NMR probes along with the center line that divides the front and back halves.*** Center the probes vertically. Click the **MEASURE** control button on the HP 3458A control panel. Slightly rotate the probe to maximize the measurement of the HP 3458A control.



Step 14. Click the **RETURN TO MAIN** control button on the HP 3458A control panel to quit the sub-control panel.

Step 15. Click the **MOTOR STAGE** control button on the main control panel to launch the motor stage control panel.

Step 16. Move the NMR #1 probe into the center of the magnet as shown in the diagram above. Reset the position to zero by click the **ZERO RESET** control button.

Step 17. Click the **RETURN TO MAIN** control button on the **MOTOR STAGE** control panel to quit the sub-control panel.

System Calibration Procedure

Before you click the **START CALIB** control button, the following Steps have to be completed.

Step 18. Enter the Manufacture, Part Number, and Serial Number information of the probe needs to be calibrated into the **COMMENTS** field.

Step 19. Enter the **k** constant provided by the manufacture into the **Constant k** field, in Tesla/Volts.

Step 20. Enter the calibration scan start, step, and finish fields in the **Start, Step**, and **Finish** fields, in Gauss unit. If the numbers you enter exceed their limits, the program will pop out a window to warn you that the numbers are out of the limits.

Step 21. Click the **START CALIB** control button to start the scan. The program will pup out a window ask you to enter file name for the data to save. Enter a name and click OK. You may then sit back and relax. A typical calibration scan with

Start: -15,000 Gauss
Step: 200 Gauss
Finish: +15,000 Gauss

takes about 4 hours and 15 minutes to complete.

During a calibration scan, the **PAUSE/RESUME, ABORT,** and **STOP MOTOR!** Control Buttons are activated.

- **PAUSE/RESUME** Control Button: Click once to pause the scan if a calibration scan is in progress. In the Pause state, the control button becomes RESUME. Click second time to resume the scan.
- **ABORT** Control Button: Click once during a calibration scan will abort the scan. The scan will not be completed. However, the calibrated data along with all the user comments, **k** constant, and zero offset information will be saved into a file.
- **STOP MOTOR!** Control Button: Click once to stop the motor if it is running. Click the **STOP MOTOR!** Control Button will abort the scan. ***The* STOP MOTOR! *control button is for emergency use only.***

Step 22. After the scan is finished, the program will set the MPS-853 Magnetic Power to zero current and turn off the output power, move the motorized stage back to zero (probe #1) position, and pop out a window to inform you that the scan is successfully completed. Click **OK** to finish the task. You may go back to **Data Plotting** section to find out how to plot the calibration data.

Trouble Shooting

If the MPS READY/MPS STANDBY indicator stays in MPS STANDBY during a calibration scan, you may have to abort the scan and go to the MPS Control Panel by clicking the MPS 853 control button on the main control panel, check the interlock status menu.

If any interlocks of the MPS 853 Magnetic Power Supply are tripped off, you have to go to the Power Supply physical control panel to reset the alarms by press the Reset Button on the control panel after you clear all the alarms.

If the DTM-141 reference field is much smaller then the NMR measurement, which means the DTM-141 Hall Probe is not well aligned to the field. Go to Step 12 of the System Calibration Procedures to re-align the Hall Probe.

If the Calibration data offsets negatively reference to the zero field, with the zero offset point, which means the Hall Probe under calibration is not well aligned to the field. Go to Step 15 of the System Calibration Procedures to re-align the Hall Probe.